

# Reconstruction of the Heat Supply System at Izumrud Enterprise, Kiev Ukraine



**Transferable Solution**

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**Project Title :** Reconstruction of the Heat Supply System at Izumrud Enterprise

**Leader:** Izumrud Enterprise, Kiev, Ukraine

**Partners:** 1) GOGAS Raduzhnij, Vladimir, Russia; 2) LOTA Ltd, Kiev, Ukraine

**Location:** Kiev, Ukraine

**Project Duration:** September 2000 - December 2001

**EcoLinks Project Investment:** Total Project Investment: \$61,466; EcoLinks Grant Support: \$42,671; Project Team Cost Share Contribution: \$18,795

## Best Practice: Transferable Solutions

The project "Reconstruction of the Heat Supply System at Izumrud Enterprise" is an EcoLinks Best Practice. The project assessed the potential to improve the environmental and economic performance of the heat supply system at Izumrud Enterprise, a gem cutting factory located in Kiev, Ukraine. The methodology for conducting an energy audit of the heat supply system and the development and implementation of recommendations to improve the efficiency of the system is highly

transferable to other industrial manufacturers with autonomous boiler heat systems in the NIS.

As a result of the efficiency improvement measures implemented through this project, Izumrud reduced its consumption of natural gas for heating by 15% and consumption of electric energy by over 10%. These reductions represent an annual savings of over \$8,000 per year. Efficiency improvements have also resulted in reduction of NO<sub>x</sub> emissions by over 50%, reduction in CO emissions by over 45% and reduction in CO<sub>2</sub> emissions by almost 20%. Environmental fees paid for NO<sub>x</sub> and CO emissions were likewise reduced by approximately 50%.

## **Project Summary**

Izumrud Enterprise is a gem cutting factory located in Kiev, Ukraine. Izumrud facilities were built in 1969. In 1997, a modern, autonomous boiler for heat and hot water supply was constructed for the plant facilities (providing heat and hot water to over 80,000 m<sup>3</sup> of building space). Prior to project implementation, however, the heat supply system (which supplies heat and hot water through over 5 km of pipes), had not been significantly upgraded since initial construction in 1969 and was badly in need of repairs and efficiency improvements.

The goal of this EcoLinks funded project was to increase the environmental and economic performance of the heat supply system at Izumrud. The Project Team first evaluated pre-project emissions levels from the heat supply system. This was followed by an energy audit of the heat supply system to identify heat losses and energy consumption. Three Izumrud employees, including Izumrud's Chief Engineer, were trained in energy audit methodology during this stage of the project. Using the data from the energy audit, recommendations on improving the efficiency of the heat supply system were developed. Recommendations included both immediate low cost measures and higher cost measures for future implementation. During the final stages of this project, lower cost measures were implemented. Post-project emissions levels from the heat supply system were also measured, to quantify emissions reductions and heat savings.

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## **Project Activities**

The goal of this project was to increase the environmental and economic performance of the heat supply system at Izumrud. Project activities included the following:

### **1. Measuring Pre-project Emissions Levels**

Action: The Project Leader subcontracted Demo, Ltd. to make pre-project measurements of the emissions from the heat supply system during low, average and high heat regimes (Demo Ltd. is licensed by the state to carry out such measurements and was recommended by the Kiev State Department for Ecological Safety). Emissions levels were registered and confirmed with the State Department of Ecological Safety and the Energy Savings Inspection Agency. These certified pre-project levels, as compared with certified post-project levels, later provided the basis for reduction in Izumrud's environmental fees paid for CO and NOx emissions by approximately 50%.

Product(s): A technical report certifying pre-project emissions levels of the heat supply system, registered by the State Department of Ecological Safety and the Energy Savings Inspection Agency.

## **2. Conducting an Energy Audit of the Heat Supply System**

Action: LOTA worked together with the Project Leader to develop an accurate scheme of the entire Izumrud heat supply system, including technical characteristics. Preliminary measurements of heat pressure throughout the system were made.

Project Partners, GOGAS and LOTA worked together in fine tuning the methodology to be used in conducting the energy audit. Audit measurements were made by LOTA and Izumrud staff. Preliminary findings from the audit showed that the main losses of the heat supply system were the result of unequal heat flows throughout the system; unstable gas pressure throughout the system; and obsolete, inefficient equipment, most notably in the combustion air heater, the air conditioning and ventilation systems.

Product(s): (1) Methodology for conducting the energy audit at Izumrud was refined. (2) Energy audit completed.

## **3. Developing and Ranking Alternatives on Efficiency Improvements**

Action: Working together with the Project Leader, Project Partners LOTA and GOGAS developed options for improving the efficiency of the entire heat supply system. Final recommendations included reconstructing the boiler automation system to optimize natural gas and air flows during combustion; installation of thermostatic valves and controls in the heating system to respond to heat demand and balance the system hydraulically; replacement of outdated pump equipment to balance hot water flow; replacement of washers; sealing off obsolete heat transport pipes; and replacement of outdated blast fans to optimize air flow during combustion.

The Project Team also developed additional, higher-cost recommendations concerning Izumrud's air conditioning system, which can be implemented in the future as funding allows.

Product(s): Recommendations for improving the efficiency of the heat supply system were developed.

#### **4. Implementation of Selected Efficiency Improvement Measures**

Action: Technical designs for carrying out the final recommendations listed in activity #3 above were jointly developed by the Project Partners LOTA and GOGAS. Implementation of these measures was carried out by Izumrud and the Scientific and Technical Center of Machine Industry, with consultation from LOTA. Implemented measures were tested for a one-month period during the heating season and fine-tuning adjustments were made.

Product(s): (1) Izumrud's boiler automation system was reconstructed; (2) Thermostatic valves and controls were installed in the heating system; (3) New pumps were installed; (4) Washers were replaced; (5) Unnecessary heat transport pipes were sealed off; (6) Blast fans were replaced.

#### **5. Measuring Post-Project Emissions Levels**

Action: Following the implementation of efficiency measures listed under point 4, Demo Ltd. once again measured emissions of the heat supply system. Results showed a significant reduction in NO<sub>x</sub>, CO and CO<sub>2</sub> emissions. These results have been registered and confirmed with the State Department of Ecological Safety and the Energy Savings Inspection Agency.

Product(s): A technical report certifying post-project emissions levels of the heat supply system, registered by the State Department of Ecological Safety and the Energy Savings Inspection Agency.

## **Project Benefits**

This project resulted in environmental, economic and capacity building benefits. Capacity building benefits were achieved through training for Izumrud staff in how to conduct an energy audit. Environmental benefits include significantly reduced emissions and reduced natural gas and electricity consumption. Finally, this project also brought significant financial benefits, through cost savings resulting from more efficient use of natural resources and reductions in environmental fees.

#### **Capacity Building Benefits**

Within the implementation of this project, Izumrud staff gained experience in conducting an energy audit and in analyzing audit results. This experience included methodology and data collection and calculation, as well as the use of measurement instruments. Through the involvement of Izumrud staff in the energy audit, Izumrud's team of engineers was able to observe firsthand the cost of energy losses to Izumrud. The training provided by LOTA and GOGAS to Izumrud staff in conducting an energy audit will not only allow Izumrud engineers to assess and monitor energy efficiency throughout the plant facilities in the future, but also convincingly demonstrated the cost of current energy losses.

## Environmental Benefits

Through implementation of efficiency recommendations on the heat supply system, Izumrud reduced its consumption of natural gas for heating by 15% and consumption of electric energy by over 10%. These efficiency improvements have also resulted in reduction of NOx emissions by over 50%, CO by over 45% and CO<sub>2</sub> by almost 20%.

Implemented low-cost measures:

	Pre-project annual emissions	Post-project annual emissions	Annual reduction
Nox	0.785tons	0.314tons	0.472tons
CO	0.412tons	0.222tons	0.190tons
CO <sub>2</sub>	1058tons	857tons	201tons

## Economic Benefits

Economic benefits from this project result from efficiency improvement measures carried out on the heat distribution system. Specifically, prior to project implementation, Izumrud enterprise's boiler used 345,000 m<sup>3</sup> of natural gas per year. After efficiency measures, the boiler uses 245,000 m<sup>3</sup> per year, equaling a savings of 100,000 m<sup>3</sup>. Since Izumrud pays \$68/per 1000 m<sup>3</sup> of natural gas, this equals a savings of \$6,800 annually.

In addition, reconstruction of measures on the heat distribution system resulted in measurable savings in electric energy. Prior to project implementation, Izumrud consumed 162,000 kWh, annually. After reconstruction measures on the heating system, electric consumption dropped to 144,000 kWh annually. Izumrud pays \$0.038 per kWh, thus energy savings represent almost \$700 a year in savings.

In connection with NOx and CO emissions reductions, Izumrud's corresponding environmental fees on NOx and CO will be reduced by approximately 50%.

## Lessons Learned

Lessons learned during the implementation of this project include the following:

- In energy efficiency projects undertaken in the industrial sector in NIS countries, the most difficult part of project implementation is often convincing management that economic savings from implementing energy efficiency measures can be significant. In the case of the Izumrud project, for example, the participation of Izumrud staff in the energy audit was critical in convincing Izumrud's team of engineers and management that energy losses in the system represented real costs to the company.
- Such energy efficiency projects will be most attractive for industrial producers in countries like Ukraine, where energy tariffs have sharply risen over the past several years and are approaching actual market prices.

## **Contact Information**

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